

HVDC Gas Insulated Switchgear Demonstration - WP 15

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- Context & Motivations
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- Specifications
- GIS demonstrator
- Partial discharge under DC
- Initiation of standardization



Context and motivations

Offshore HVDC Grid control and protection require new switchgears and components providing :

- Compactness
- Adequacy to “new” DC stresses
- High reliability level



<http://electrical-engineering-portal.com/gas-insulated-substation-gis-vs-ais>

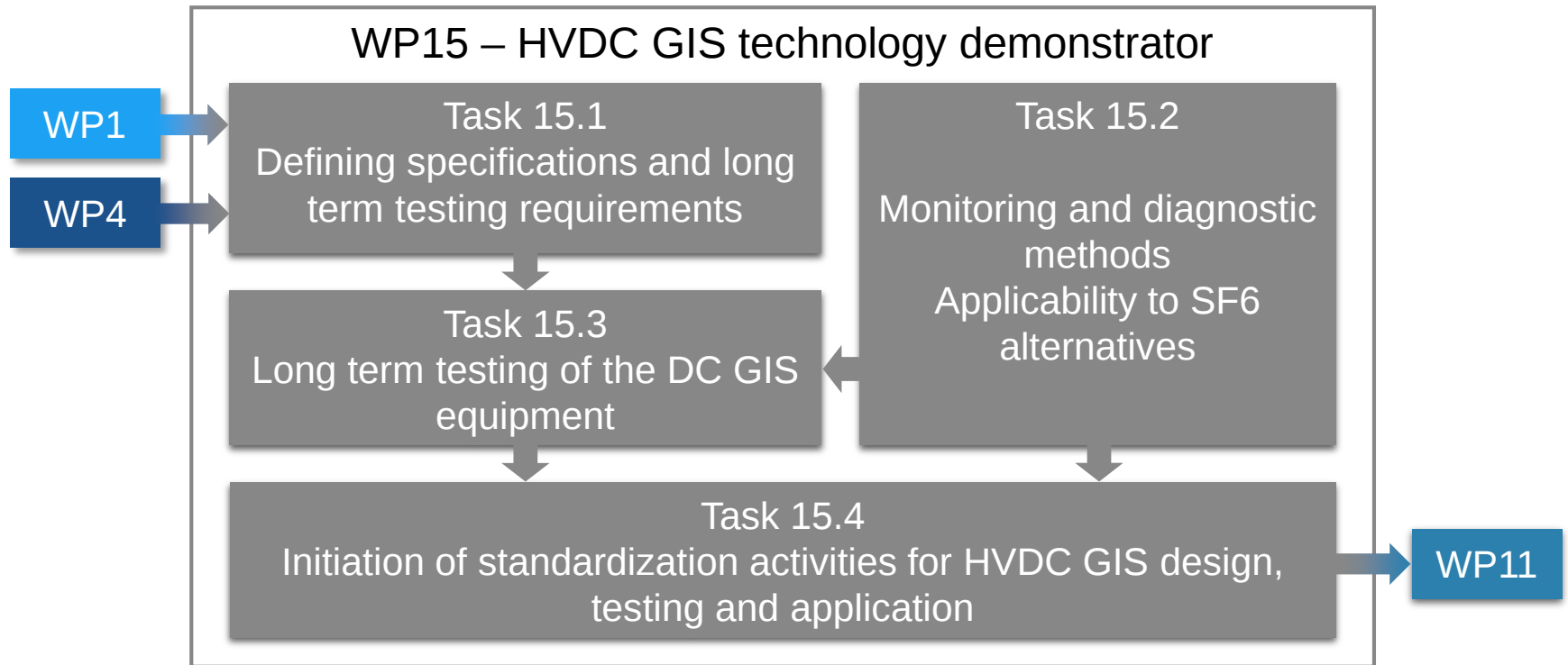
Gas Insulated Switchgear technology (GIS) offer advantages like :

- **Reduced footprint and weight**
(70%-90% volumetric reduction of the switchyard compared to AIS)
- **Insensitiveness to pollution** and climatic conditions
- **High reliability** (no ageing under neutral gaseous atmosphere)



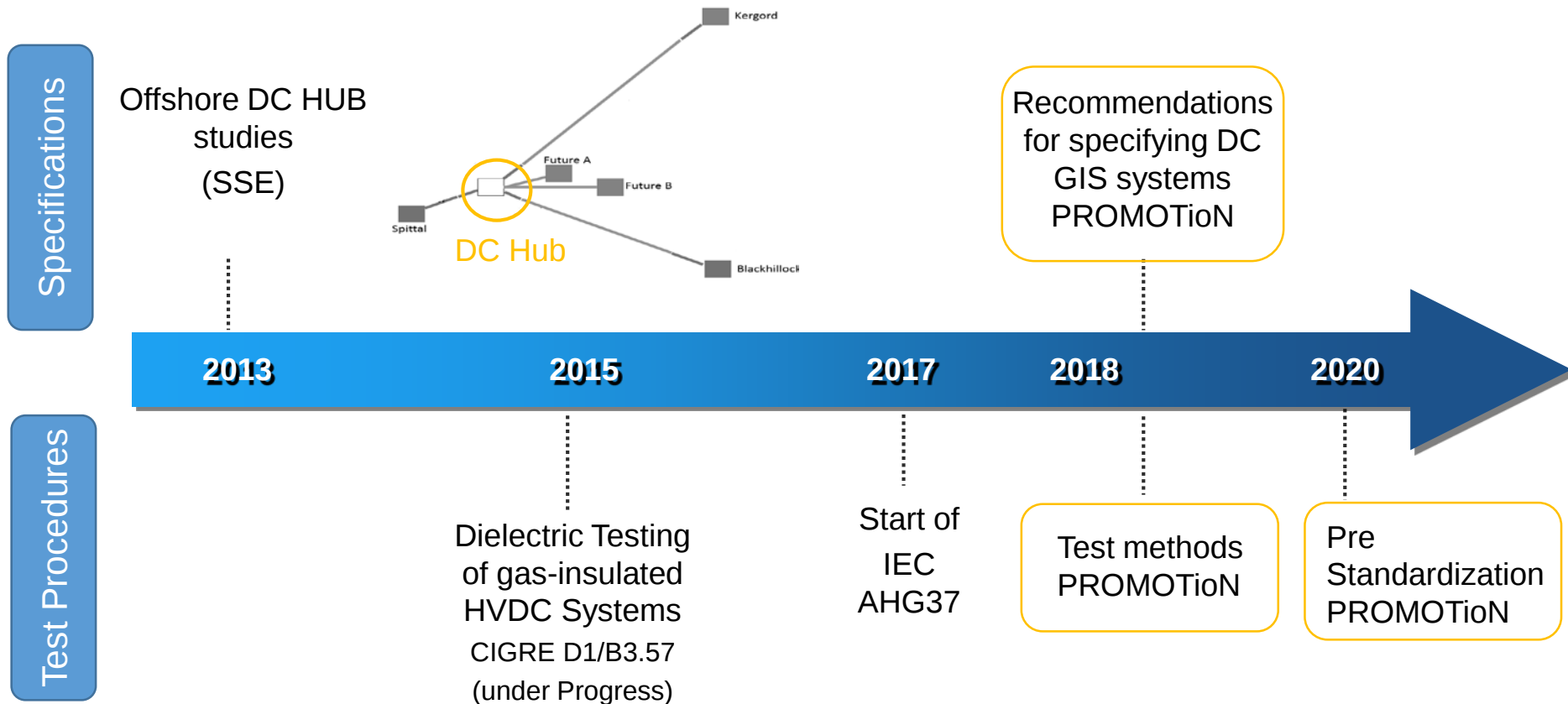
GIS technology needs to be investigated and proved mature to facilitate the development of HVDC Offshore grids

Work package organisation



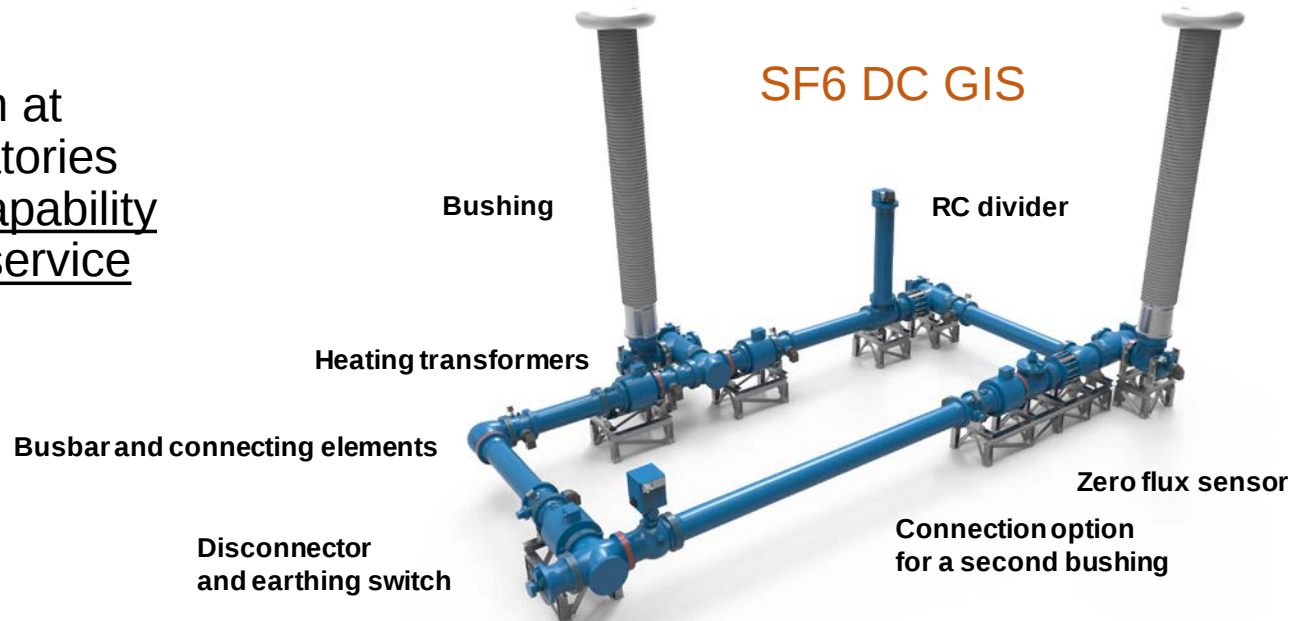
Specifications and test procedures

System specifications and test requirements of the HVDC GIS demonstrator rely on HVAC GIS experience, HVDC cable's test requirements and on recent works:



Performance demonstration of a HVDC GIS system

Extensive test program at DNV GL KEMA laboratories will demonstrate the capability of the GIS to fulfil the service life requirements



Milestones	Tests
Sep. and Oct. 2018	Commissioning
Nov. 2018 to Nov. 2019	Long term
After Nov. 2019	Additional

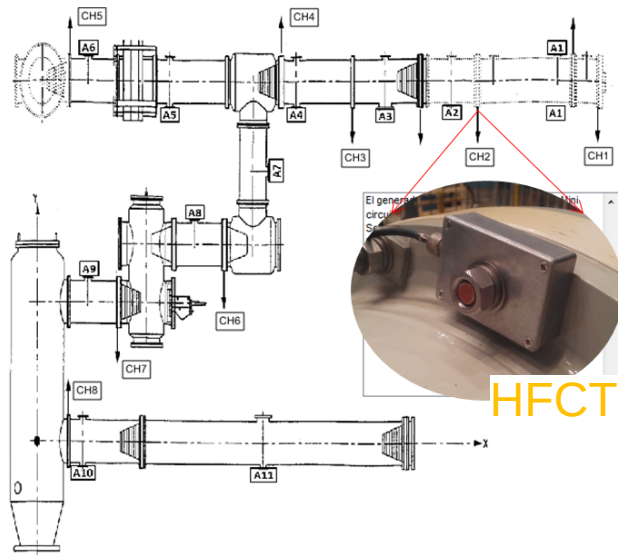
Demonstrator	Value	Unit
Pre-Tests Thermal calibration, C _g tests, PD, LI, SI		
Long-term test cycles	± 1.0 ... 1.2 HL (AC equivalent)	pu
Rated superimposed LI / SI	± 0.8	pu
Long-term test cycles with DC	± 1.0 ... 1.2 ZL	pu
Rated superimposed LI / SI withstand v	± 0.8	pu
Final verification tests & additional tests		

Under discussions

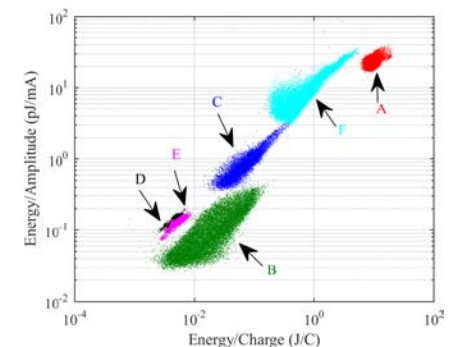
HL : High Load ZL: Zero Load

Partial discharge monitoring : measuring techniques

- Condition monitoring of GIS is greatly appreciated by system's operators for AC but is **not mature for DC yet**:
 - From measurement techniques perspectives
 - From defect patterns and recognition algorithms perspectives
- Investigations are launched to investigate **classical** and **a new** techniques:
 - Conventional method
 - UHF
 - Light emission
 - High Frequency Current transformer (HFCT)



Outcomes of the work tend to prove that condition monitoring is also available for DC and will support the acceptance of the technology introduction



Partial discharge monitoring : database & SF6 alternatives

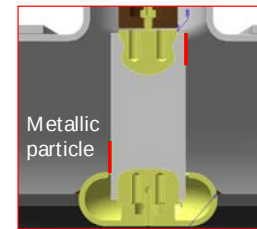
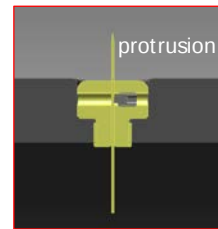
Substitutes to SF6 gas are emerging and products are commercially available for AC

Different gas mixtures

FN-CO2 / AirPlus / SF6



Different defects and test conditions



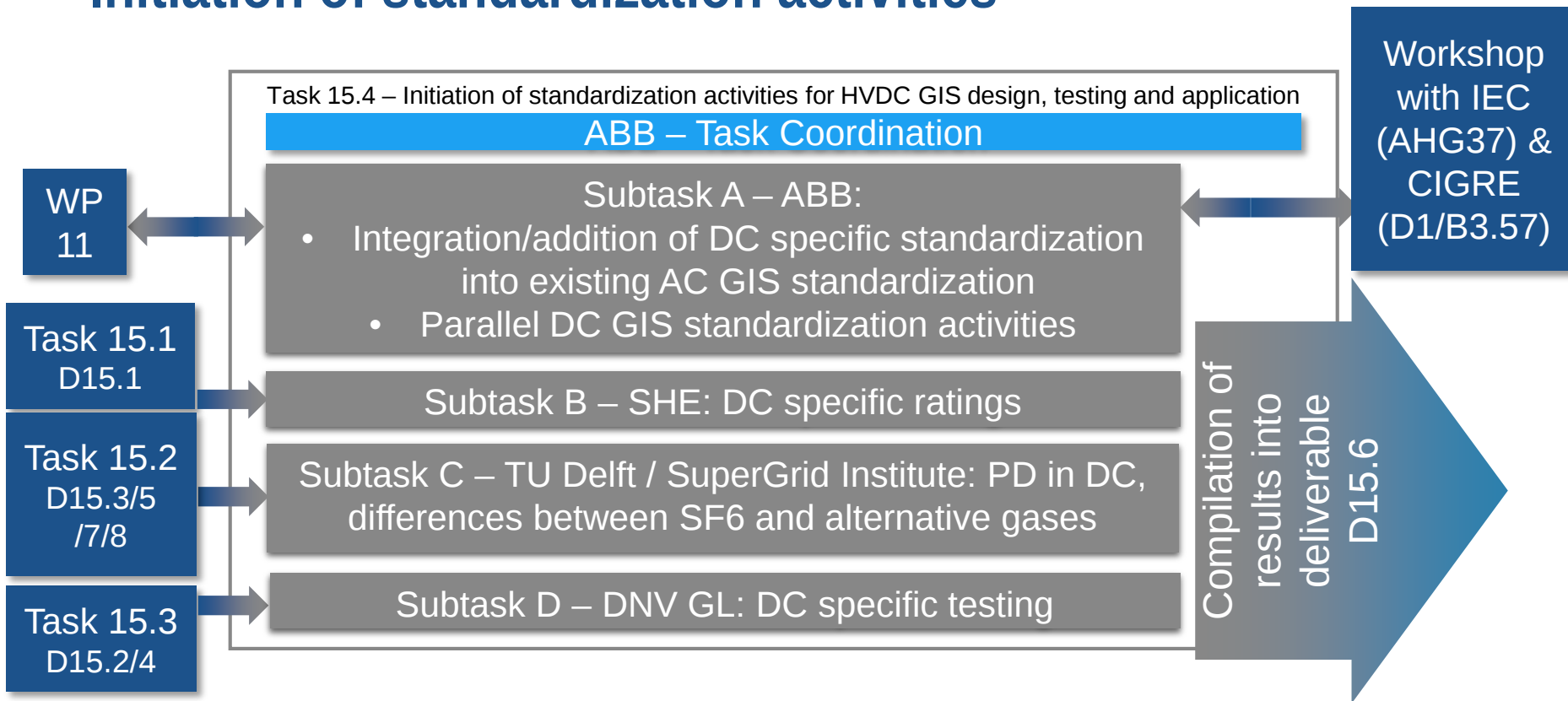
Observed with the 4 measuring techniques



Background knowledge on PD recognition strategies for DC GIS

- ➔ 2018 : Tests realization, data collection, pattern recognition and main conclusions
- ➔ 2019 : Long term test to study the evolution of calibrated defect in DC GIS and the reliability of the measuring techniques

Initiation of standardization activities



An important step forward towards technology maturity evidence and acceptance